The Macdonald Journal

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HORTICULTURE SPECIAL ISSUE

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In This Issue

Journal Jottings

Be it a pint-size garden or hectares devoted to onions, carrots, or peas, a couple of trees for home use or thousands for one's livelihood, an African violet on the kitchen window sill or greenhouses filled with bedding plants, tomatoes or cucumbers, a hobby or a way of life: nearly all of us are interested in what is happening in the horticultural area. A great deal is as you will find from reading the articles in this special issue which was very ably coordinated by Professor K.A. Stewart of the Department of Plant Science. Due to lack of space, two articles on processing and storage written for this issue must be held back. We're sorry but plan to publish them as early as possible in '82.

Hazel M. Clarke

McGill University Stuart McDonald Memorial Award

The "McGill University Stuart McDonald Memorial Award" is being proposed in memory of Stuart McDonald who died at the age of 35 on Sunday, November 22, 1981.

Stuart McDonald was a Diploma graduate in 1966 and a B.Sc. (Agr.) graduate in 1971. He is remembered by classmates as a leader in student affairs and as a person of great integrity who could be counted on to do more than his share on any project he undertook. He worked for two years as one of the original staff members of the Dairy Herd Analysis Service and, after graduating in 1971, he was employed by Slack Bros. of Waterloo, Quebec, a large mushroom growing corporation. At the time of his death, Stuart McDonald was vice president in charge of sales.

The Memorial Award will be given to a Diploma or Degree student on an alternate year basis. The candidate, who will normally be in the final year of the program, will possess characteristics similar to those of Stuart McDonald and will have good academic standing.

Those wishing to make donations may send cheques to the attention of: Professor R.S. Broughton, Chairman, Scholarships Committee, Faculty of Agriculture, Macdonald Campus of McGill University, 21,111 Lakeshore Road, Ste. Anne de Bellevue, Que., H9X 1C0. Receipts for Income Tax purposes will be sent to donors.

Editorial

Horticulture:
The Challenges and Opportunities

This issue of the Journal is devoted to horticulture, a very important subject for all of us. It is the source of fruits and vegetables needed for our well-being. It supplies us with the shrubs, the trees, the flowers, and other ornamentals with which we surround ourselves to create a pleasant environment in which to live. It creates employment not only in the actual production but also in the supply side to raise these crops such as fertilizers, pesticides, and machinery and, more importantly for our own production, in the storage, processing, distribution, and marketing activities.

In a recent publication of the Quebec Ministry of Agriculture, Fisheries and Food entitled "Nourrir le Québec" it is reported that the per capita consumption of fruits in this province is 107 kilograms, that of vegetables is 133 kilograms, and that of potatoes, 117 kilograms, farm weight. This indicates that there is a vast market potential for our production. It is quite clear that because of our climatic conditions, in particular our short growing season, we cannot hope to satisfy our needs completely. We cannot produce oranges or bananas or lettuce, celery, and tomatoes in the winter, but we can extend the marketing season of many of our crops in the fresh state or process them so that they will find their way on to the grocers' shelves.

The disaster that struck the apple industry last winter provides the occasion to review the production of this fruit in Quebec. The introduction of new varieties that can store well and be marketed at different times of the year is a possibility. The planting of varieties suitable for processing can be considered to satisfy the demand for apples processed in forms other than juice or sauce. The implantation of other species such as pears, plums, and cherries currently being investigated at Agriculture Canada Research Station in St-Jean would also meet a certain demand for these fruits.

Melons and cantaloupes used to be produced in fair amounts in the Montreal area many years ago. Some people still long for the delicate flavour of the Oka melon and the Montreal melon. This production disappeared with the arrival of fast transportation from distant lands and modern handling methods. Because of increasing energy costs facing such methods, it could again be possible to produce these crops using mulches, plastic tunnels, or individual plastic tents.

Vegetable production also offers possibilities for expansion. By using known techniques which have proven advantageous, such as plastic mulches or by developing new ones such as fluid drilling of seeds, it is reasonable to expect earlier production of many vegetables, such as tomatoes, peppers, and eggplants, thereby capturing some of the market. Expanded storage facilities using some of the innovative methods such as the various systems for controlling the composition of the atmosphere would place some of our locally grown produce on the market for a longer period than at present.

The document already cited "Nourrir le Québec" reports that tomatoes are the most popular vegetable consumed in Quebec, namely 61 kilograms per person or 41 per cent of the total vegetable consumption. A large part of that quantity is eaten in the processed form: canned, juice, ketchup, paste purée, soup, etc. Unfortunately, very little of this is processed in this province. While it is not possible to produce all these products, it should be feasible to process some, such as canned tomatoes. Research is on the way to create suitable varieties for that purpose. Processors in this province have the facilities to can additional vegetables if they were available, e.g., asparagus. Efforts have to be increased in these areas.

Finally, the vast field of ornamentals offers great potential. In a document entitled "Les fruits et légumes et l'horticulture ornementale", it is pointed out that the Quebec consumer buys $85 million of nursery stock, $100 million of cut flowers and house plants and that the producers engaged in this activity have less than 14 per cent of this market This points out the need fot the introduction of innovative production and marketing techniques which will assist these growers in supplying the needs to a great extent.

Horticulture is a challenging field which offers many opportunities for expansion in areas other than those that are currently filled. These opportunities must not go by the wayside.

Dr. Jean David
Associate Dean, Public Relations and Professor of Horticulture, Department of Plant Science.

The Ornamental Horticultural Industry

by Professor Calvin Chong
Department of Plant Science

Throughout history man has been dependant on plants for food, shelter, medicinal and other uses. Many cultures considered trees with religious regard and as symbols of strength and longevity. The use of plants for beautification dates back to ancient times and evolved originally as a hobby and art pursued by the rich and influential. In the 1660s King Louis XIV extravagantly spent millions of dollars to beautify his hunting lodge. This project was of such magnitude that there were up to 36,000 workers at one time and it took 25 years to develop.

During the 17th to 19th centuries, settlers introducing new varieties of seeds and stock plants to the new world influenced greatly the early proliferation of garden and plant societies, many of which still exist today. In the United States during the 1930s demand for shade trees, shrubs, and roses surprisingly surpassed demand for fruit trees. In the ensuing decades the production and use of ornamentals became recognized as facets of horticulture; in a narrow sense, ornamental horticulture was thought of as an art and science related to the culture and use of plants primarily for beauty or aesthetic quality of form, foliage, flowers, or fruit.

Ornamentals — A Growth industry

Horticulture experienced unprecedented popularity and growth during the past decade. Even in a small way, many people wanted to get back to the land. The enrollment in all types of horticultural courses, increasing plant sales, and enthusiasm for allotment gardens continues even today. Of the three major horticulture production sectors, namely, fruit crops, vegetable crops, and ornamental crops, ornamentals have shown the most rapid growth increases and dramatic changes.

The growing of ornamental plants is becoming the concern of an increasing segment of our population. In affluent Canada, where horticultural crops represent 30 per cent of the food consumed, many plants we consider basically as ornamental in nature produce edible parts that can be used as fruit (apples, crabapples), vegetable (cole crops, herbs), and nutritious beverage or condiment (rose hips). Interestingly, pine needles were used by the Canadian Indians as a good source of vitamin C, after extraction by boiling, to combat against scurvy. Indians of the Great Lakes regions also used *Aster* flowers as medicinal tea.
Of the estimated $1,000 million in total farm gate value of fruits, vegetables, and ornamentals produced in Canada, ornamental crops now account for approximately one third of this value. At present there are no reliable estimates of the retail value of ornamentals and of directly related supply and services of allied industries across Canada. Recent modest estimates for Quebec alone have ranged between $100-150 million. Notwithstanding shadows of economic doom and gloom cast by the effects of prolonged recession and increasing costs of energy and interest rates, and although sales have not been as brisk in the past several years as in the mid-70s, outlook for the ornamental industry continues to be optimistic. Of all segments of the horticulture industry, the ornamental sector appears to have possibilities for the greatest growth potential. In fact, some in the ornamental industry continue to refer to the coming years as the "blooming 80s".

Facets of Ornamental Horticulture

Ornamental plant production can be categorized under two major divisions: 1) floricultural and related greenhouse crops, including potted flowering plants, cut flowers, foliage (green) plants for interior use, and bedding plants for transplanting to outdoor gardens; 2) nursery and landscape crops, including trees, shrubs, vines, ground covers, and turf. Bedding plants are being produced by traditional greenhouse producers and increasingly by nurserymen using plastic greenhouses. Since ornamental horticulture includes all aspects of production, culture, and marketing of the above crops, and the utilization of these crops by professional landscape architects, contractors and maintenance personnel as well as by consumers, ornamental horticulture with its allied industries is of great importance to our society.

Management executives are now realizing the importance of landscaping and grounds maintenance to create an appealing ambiance to their establishments. By virtue of its close association with other sectors of horticulture and agriculture, and with numerous allied industries such as seed companies, farm co-ops, manufacturers of garden tools, fertilizers, farm machinery, and other farm-related products, ornamental horticulture is considered a vital agricultural entity.

Currently sophisticated and expensive, large-scale interiorscaping projects in atriums inside modern shopping centres and hotels are gaining in popularity. These projects include many tropical plants, such as large woody plant specimens or palm trees imported from Florida and other tropical areas, and require the specialized skill and supervision of professional interior designers as well as experts in lighting and maintenance of these types of plants indoors.

Benefits

Aesthetical and Symbolical Ornamental plants possess certain intrinsic beauty or qualities which satisfy our basic needs for aesthetic and other instinctual or symbolical

values previously alluded to. In today's society the bestowing of wreaths, bouquets, and floral arrangements or use of flowers and certain ornamental plants to express a variety of moods or sentiments can be easily appreciated. However, besides these aesthetic and symbolic functions, ornamental horticulture, in a contemporary sense, provides other important benefits to society and endeavours to be a dynamic field of activity that is attentive to new trends and ready to meet the future.

Physical and Ecological As a result of recent public interest and concern for the environment triggered by the "green revolution" movement, we are becoming more aware of the important physical and ecological roles of plants in our surroundings. In the process of photosynthesis, plants utilize carbon dioxide and water and replenish the atmosphere with oxygen, making all life possible. Thus, plants are the world's largest air conditioning system. It is estimated that plants cycle annually two billion pounds of carbon, one of the major building blocks of life. As a renewable resource, plants fuel our power plants which in turn "fuel" our economy. Plants in the landscape preserve our environment by acting as dust traps and by controlling air pollution and soil erosion. The use of ornamental plants in the landscape reflects our quality of living. They enhance our environment and increase our living standards by controlling sight pollution and by beautifying our surroundings. Ground covers such as spreading juniper or Virginia creeper reduce maintenance costs by covering whole areas. Appropriately planted ornamental plants help to conserve energy during the winter by serving as windbreaks or providing shade in the summertime.

Medicinal Value Although many plants are used as drugs because of their medicinal properties, we have recently re-awakened to the fact that "the growing of plants for the mere pleasure of growing" is in itself of medicinal value. Gardening to help the mentally ill has been practiced for centuries. As early as the 1700s doctors prescribed gardening for "ills of the mind". The growing of plants and their systematic use in our environment such as to combat noise and sight pollution is being used to alleviate human stress — social, physical, and psychological. Growing plants helps certain kinds of patients, such as the depressed or mentally retarded, make more productive and constructive use of their time.

Gardening costs much less than many other hobbies. As inflation increases and energy prices soar, more people stay at home to grow plants, to pass the time, and to use their increasing leisure hours in a constructive way. A walk will use up 210 calories, gardening 230. Thus gardening provides good recreation and helps ease tension and tension-related diseases.

Horticultural therapy as a recognized field has been in existence only since 1973 when the National Council for Therapy and Rehabilitation through Horticulture was created to coordinate efforts in this area. Membership extends across the United States, Canada, and England. Thus the care of ornamental plants is considered to have medicinal value.

Economic Impact As previously indicated, ornamental horticulture, together with its allied industries, is big business. As long as consumers will buy plants, floriculturists and nurserymen will grow them. This means employment and job opportunities for many in horticulture.

Experience has shown that it is more difficult to sell homes without trees as compared to landscaped homes and also that the price of landscaped homes is much higher. A tree may be valued anywhere from $300-500 (mature trees) or higher. There is one case where as much as $75,000 was paid for digging, transporting, and transplanting one single large tree! Many of our larger elm trees are dying because of the fatal Dutch elm disease. These trees are very valuable to us. Consumers have paid up to $200 or more per tree to treat elms against this disease. Unfortunately, treatment is at most only temporary since there is no dependable permanent control.

The growing of trees, such as Christmas trees, whether as a full time nursery operation or as a hobby farm operation, is a very good tax shelter and can be a very profitable venture. The value of trees is constantly increasing, often as much as or more than the rate of inflation. In fact, when gold was rapidly increasing in value, one nurseryman wryly indicated that growing ornamental trees and shrubs is like having gold stored away.

Ornamental Horticulture at Macdonald

In the Department of Plant Science at Macdonald, several courses are provided in Ornamental Horticulture to complement the Horticulture Option. Two courses in ornamental horticulture provided to degree students include the production and culture of (a) greenhouse floricultural crops, and (b) nursery and landscape crops. There is also, at present, a course provided in landscape architecture. Another production course covering most facets of ornamental horticulture is provided to diploma level students.

In any research program projects are usually aimed at solving specific problems of concern. For instance, a good propagation program is a fundamental prerequisite to the production of ornamental nursery stocks. It is important that nurseries know how to propagate many of their planting material, but many of these stocks are difficult to vegetatively propagate and require a lengthy period to produce salable plants. Since 80 per cent of ornamental plant materials sold in Quebec are imported from other parts of Canada, the U.S.A., and elsewhere, there is much room for growth in the production aspect of ornamentals in Quebec. In the Department of Plant Science at Macdonald, a current research program sponsored by the Conseil des recherches et services agricoles du Québec is aiming to develop more effective methods and techniques for the production of woody ornamental and related fruit nursery stocks, with emphasis on more difficult to propagate species.

One aspect of this study deals with the development of the tissue culture approach for producing large numbers of plants in test tubes. This method of culture is described in an accompanying article in this issue.

Horticultural Crop Production. . .

. . . By Tissue Culture

by Professor Calvin Chong
Department of Plant Science

In recent years tissue culture — the cultivation of cells, tissues, or organs under artificial conditions — has had a great impact on the horticultural trade. First conceived and attempted by a German scientist, Gottlieb Haberlandt at the turn of the century, concrete results began to appear only in the 1960s.

A Commercial Reality

In the early 1970s commercial laboratories were just beginning production of tissue-cultured plants. This 20th century biotechnology can now be considered well beyond the experimental stage as numerous commercial labs have sprung up across the United States, Europe, and Canada within the past five years. Many of these labs are in full scale production, supplying the market with many disease-free, cheaper-to-produce tropical foliage plants and flower crops. At one of the most sophisticated commercial labs located in Florida, as many as 130 different varieties of plants are produced by tissue culture.

There are, at present, several commercial labs operating in Canada. The tissue culture lab of Serre Dion near Ste-Eustache, Quebec, has been in production for several years. With a capacity for 20,000 test-tubes in a 3m by 6m area, this lab routinely mass propagates 10 floricultural species and is currently experimenting with at least 35 more species or varieties. In Oka, Quebec, the lab of Pierre Noreau has been specializing in tissue culture propagation of blueberries and apple rootstocks within the past year.

Production Procedures

The tissue culture technique most commonly used in commercial horticulture is not a simple procedure. It involves a series of steps which must be perfected for each crop or cultivar.

Stage I is the establishment of the culture. The part of the plant that is used depends on the particular crop. Normally shoot tips 1 to 2 cm long or lateral buds, referred to as explants, are used. These are disinfected in a mild bleach solution, such as diluted Javex or Clorox, and are placed into test-tubes or culture bottles containing the nutrient medium. This work is done in a lab using scalpels and other sterilized surgical instruments in a laminar air flow hood, a device which filters pathogen-free air across the working area. Cultures may also be started from tiny meristem tips 1 to 2 mm long excised with the aid of a microscope after the outer primary leaves are removed. Runners, bulb scales, leaves, roots, seeds, and other living plant parts can be used as explants.

The nutrient medium usually contains a mixture of mineral salts such as nitrate, ammonia, phosphate, potassium, and trace elements; sugar; various vitamins and hormones to promote shoot growth; and water and agar, a gelling substance made from seaweed, which gives the medium a "jelly-like" consistency to support the plant tissue. The medium provides a very rich growing environment. Fungi and bacteria that may be on the plant will also grow well and, therefore, must be removed from the plant pieces before being put into culture. Explants grow quickly in the test-tube because they are not hindered by diseases or other pathogens.

Cultures are moved into a temperature-controlled growth room usually kept at 26-27°C and lighted with fluorescent tubes 16 hours per day. Usually after several weeks each explant will produce between 5 and 30 side shoots which can be individually cut off. Shoots may also arise indirectly from disorganized tissue growth known as callus.

Stage II is multiplication. Individual shoots from Stage I are transferred

The 3 m by 6 m tissue culture laboratory at Serre Dion near Ste. Eustache has the capacity for 20,000 test-tubes.



Left: Proliferating (Stage II) African violets. Centre: Tissue culture produced African violets being acclimated (Stage IV) after being rooted and potted in sterile medium. Right: Tissue culture produced African violets ready for growing on or for shipping.

into fresh culture medium, usually of similar formulation and allowed to reproduce, and then re-transferred again. This reproduction and transfer process is allowed to continue until enough plants are produced to meet requirements.

Stage III is rooting and **Stage IV** is acclimatization to soil and greenhouse conditions. Individual shoots from Stage II are transferred into another type of medium containing special root-promoting hormones. Rooted plants are transplanted to sterile soil mix in pots, after the agar medium is removed by washing, and placed in a greenhouse environment under shade and high humidity to condition them to the external environment before shipment or planting in the field. Some plants may root directly in Stage II medium and may be transferred directly to sterile soil mix. In other species miniature shoots from Stage II can be placed directly in conventional rooting medium under intermittent mist for rooting to take place.

Expensive Operation

A small tissue culture laboratory using items such as a pressure cooker for sterilization of media, a household stove, a simple scale, a small transfer case made of plexiglass, and a small growing area with shelves and fluorescent lights could be started for a hundred to a few thousand dollars but working under these circumstances is awkward and production would be limited.

In addition to greenhouse space, a typical commercial tissue culture lab, with a sufficiently large sales volume to make a viable operation, is expensive to establish. For instance, costs for building, equipment, and chemicals of Ogelsby Nursery's tissue culture lab in Florida were in the order of $100,000, with a capacity for producing as many as three to six million plants a year. In Italy, where tissue culture propagation of strawberries is well established, one major laboratory produces one million plants per year and the cost of the facility, one of the best designed in the world, was approximately $300,000.

Highly trained personnel are required to operate these facilities and this also can be expensive. Basic training for personnel can be obtained from the W. Alton Jones Cell Science Centre, Lake Placid, New York, 12946, which offers at least two courses each year on tissue culture techniques for propagators. Many universities and research institutions now have tissue culture laboratories and may offer courses. The Department of Plant Science at Macdonald offers a course in tissue culture to post-graduate trainees.

Benefits

The benefits of tissue-culture of "cloned" plants are many and varied. Basically a reproductive process by cellular multiplication, tissue culture produces astonishing numbers of plants that are carbon copies of a single parent, unlike seedlings which may vary greatly in size and colour from the mother parent. Starting with 10 buds with a multiplication rate of 10 times, it is estimated that one million plants could be produced within 25 weeks. Production time and requirement for space, labour, and maintenance are less than by conventional methods. For example, in one Florida lab Gerberas grown from seeds bloom in seven to nine months; using the tissue culture procedure Gerberas flower in three months — in one third the time at one half the cost.

One thousand day lilies are produced in a week on 30 square feet of shelf space compared to the one-half acre needed to grow the same number in pots outdoors. Unlike outdoor propagation, production takes place all year round and the system is flexible. It can be programed to meet changes in production demand much more readily.

Tissue culture is now routinely used to produce virus-free, high-yielding planting stocks, such as potatoes, strawberries, and carnations grown from the tiny meristem tips. In tissue culture a virus-free status of plants can be maintained because of the sterile conditions in which they grow. Therefore such plants should be free to enter any country without much difficulty.

Some Concern

Genetic stability is a concern in certain horticultural crops. For instance, strawberries produced by tissue culture in large numbers in Europe have developed some strange behaviours in a relatively small number of plants and at present the cause is not known. For instance, testing of tissue culture strawberries at the United States Department of Agriculture, Maryland, indicates that yield appears to be similar to conventionally propagated plants, but fruit size seems to be smaller. This may or may not be reason for concern, but this aspect of tissue culture plants must be watched very closely.

In many horticultural species, the techniques have been perfected; in others much work needs to be done. Some of the berries, including strawberries and raspberries, and grape and certain fruit tree rootstocks, such as M26, and MM111, EM7A, and EM 4 apples and some cultivar sources, have had the techniques developed to the

point where commercial production is feasible. The possibility of less expensive trees on their own roots could lead to the establishment of high density orchards, but the potential advantage has yet to be proven in our climate. Many other crops are still in the experimental stage but the potential is there.

At present, in many labs it may not necessarily be cheaper to produce plants by tissue culture than by conventional methods. For instance, at this time, in the case of rhododendron which takes 12 to 18 months to obtain rooted cuttings from tissue culture equivalent to the size of two-month old seedling plants, the tissue culture approach is not yet economically feasible.

The Future

Tissue culture will change the production of horticultural crops during the next 20 years and will ultimately become the dominant form of plant propagation and cultivation. In breeding crop development the potential of tissue culture is unlimited. For instance, tissue culture can be used to overcome sterility barriers and to obtain new strains or cultivars of plants. Using this technique, the time of breeding and testing a new cultivar could be reduced by as much as one third. Tissue culture may be the way in which the world will be fed in the 21st century. The cloning of literally thousands of carrot plants derived from single cells in test-tubes by F.C. Steward and collaborators at Cornell University in the late 1950s represents one of the greatest milestones in the brief history of tissue culture. So far only about 10 species, including petunias and potatoes, have responded to this technique. It is estimated that one flask of cells continuously grown and nourished for a year could produce a tissue mass equal to that of the earth. Thus it is not inconceivable that we could rapidly reproduce and ship thousands of food crops ready for planting in the ground — anywhere in the ground — and perhaps also in space! According to a recent article in *BioScience,* horticultural species already chosen for an all-vegetarian diet to be used in space colonies include potatoes, kale, lettuce, and other vegetables. Scientists are now exploring the possibilities of fusing single cells of different species to create new synthetic plants, such as corn plants capable of fixing their own nitrogen similar to leguminous crops. Space-age agriculture is looking forward to the establishment of tissue culture banks which will substitute for plant nurseries and seed storage facilities to preserve superior clonal lines.

Tissue culture techniques seem to have great practical potential for many harder to propagate fruit and woody ornamental trees. In some cases, where certain species are difficult to propagate both from seed or by conventional vegetative means, tissue culture may be the only realistic approach to solving this problem. As part of a research program sponsored by the Conseil des recherches et service agricoles du Québec, the tissue culture approach is being used in the Department of Plant Science at Macdonald to develop and define viable culture procedures for mass propagation of blueberry and apple rootstocks which are currently in short supply.

With the widespread use of tissue culture, the way we produce plants may never be the same again. We've helped turn science fiction into scientific reality!

HYDROPONICS

by Elwood Quinn
Senior Technician
Department of Plant Science

Hydroponics is the science of growing plants without soil. Terms used to describe the technique are aggregate culture, nutriculture, or nutrient solution culture.

Hydroponics is not new. The hanging gardens of Babylon and the floating gardens of the Aztecs and Chinese exemplify man's early interest in alternative methods to soil production.

Research on hydroponics has been conducted for over 200 years and has primarily been used as a vehicle to study plant nutrition. Aptly it is the knowledge of the plant's nutritional requirements gained through the use of hydroponics that has allowed researchers to establish exact nutrient formulae for a range of crops (Tables 1 and 2). Propietary fertilizers can be purchased and have the advantage of ease of handling. Care must be taken to follow the instructions precisely.

Prior to preparation, a water analysis is advisable as high levels of heavy metals will be detrimental to growth, and soft water (water softened by replacing calcium and magnesium with sodium) can be toxic.

Regardless of the method by which the nutrient solutions are produced, a method of maintaining the nutrient balance must be established. It is necessary to keep the pH of the solution within a range of 5.8 to 6.7 in order to maximize nutrient availability; pH can be monitored on a small scale by the use of litmus paper and corrected by the addition of white vinegar. Commercially, pH metres, both hand-held and "inflow", are used and a 2:1 ratio of nitric and phosphoric acid (each acid diluted to a rate of 1:19 with water) applied to correct any imbalance. Nutrient elements or the salinity of the solution can be determined using conductivity metres. Levels of 2,000 to 2,500 μmhoms are suitable for tomatoes and 1,500 to 2,000 for most other crops; when levels fall below that required the solution can be rebuilt from concentrates. Metres can be purchased from nurseries; however, the cost is extremely high — beyond the pocket of most home gardeners who would do better to discard and start afresh with new solution every two weeks. Monitoring of pH and conductivity should be carried out every two days. Nutrient requirements vary with season, developmental stage, and plant type (Heavy fruiting material requires higher levels of calcium and magnesium.)

Once a formula has been chosen, the grower must determine which

hydroponic system best fits his requirements. Two possible choices are the use of aggregate culture or the nutrient film technique (NFT).

Aggregate culture

This system consists of a container, the aggregate or media, a pumping system, and the nutrient solution. The container must have a depth of at least 15 cm, be opaque (to prevent algae growth) and be watertight. Wood should be lined with polyethylene and metal coated with varnish or an asphalt sealer in order to prevent corrosion. The aggregate can take many forms: sand, gravel (particle size greater than 0.5 mm), expanded clay (haydite), vermiculite, peat, sawdust, perlite, or a combination of the above. Media, particularly the sand, gravel, and haydite, should be rinsed prior to use. Water pumps can be purchased at nurseries and a fish pump used in order to aerate the solution thereby preventing anaerobic conditions.

In one system the nutrient solution is recirculated (Figure 1). With the use of multiple growing units and a collecting tank, each unit can be placed on a different elevation requiring the solution to be pumped to the highest bed and letting it drain from one unit to the next, finally returning to the collecting tank. With any system, good drainage is necessary to ensure oxygen getting to the roots. Gravel and sand beds can be flushed every month and between each crop; water is used for flushing between crops and nutrient solution is used while the crop is in place.

Nutrients film technique (NFT)

The main features of this system are shown in Figure 2. The system consists of a catchment tank containing the nutrient solution and either a submersible or non submersible pump which delivers the solution through a rigid plastic pipe to the upper end of the channel. Each channel is connected to the pipe by two spaghetti tubes. The solution is delivered at the rate of one to two litres per minute, depending on the type of material being grown, and flows down an artificially created slope (1:25 → 1:50) to a catchment pipe which in turn drops into the catchment tank. The drop into the tank continully aerates the solution. Individual channels can be made from rain gutters, or heavy gauge plastic, or can be purchased in a premoulded form. Plants placed in an NFT channel are normally started in oasis or rockwood, in order to provide initial support and, in the case of tomatoes and cucumbers, strung for later development. The NFT method is particularly suited for commercial production, and two companies in Canada are currently marketing NFT packages.

Commercial applications of hydroponics, be it aggregate or NFT production, are steadily increasing in Europe, Australia, and North America. Each year brings system refinements and cost reductions. However, before considering the purchase of either a home garden or commercial system, the cost of the unit must be thoroughly investigated to see if it fits your particular needs.

Table 1. **Nutrient concentrations for tomatoes in nutrient film culture**

Element	Concentrations (mg/litre)		
	Minimum	Optimum	Maximum
No_3-N	50	100-200	300
P	20	50	200
K	50	300-500	600
Ca	125	150-300	400
Mg	25	50	150
Fe	1.5	3	6
Mn	0.25	1	5
Cu	0.01	0.1	1
Zn	0.05	0.1	5
B	0.1	0.2	2
Mo	0.01	0.05	0.1
Na	—	—	250
Cl	—	—	400

Source: Winsor *et al.* 1979

Table 2. **Weights (g) of pure substances to be dissolved in 100 litres of water to give theoretically ideal concentrations**

Substance	Formula	Weight
Potassium dihydrogen phospate	KH_2PO_4	263
Potassium nitrate	KNO_3	583
Calcium nitrate	$Ca(NO_3)_2 \cdot 4H_2O$	1003
Magnesium sulphate	$MgSO_4 \cdot 7H_2O$	513
EDTA iron	$(CH_2 \cdot N(CH_2 \cdot COO)_2)_2FeNa$	79
Manganous sulphate	$MnSO_4 \cdot H_2O$	6.1
Boric acid	H_3BO_3	1 7
Copper sulphate	$CuSO_4 \cdot 5H_2O$	0.39
Ammonium molybdate	$(NH_4)_6Mo_7O_{24} \cdot 4H_2O$	0.37
Zinc sulphate	$ZnSO_4 \cdot 7H_2O$	0.44

Source: Cooper 1979

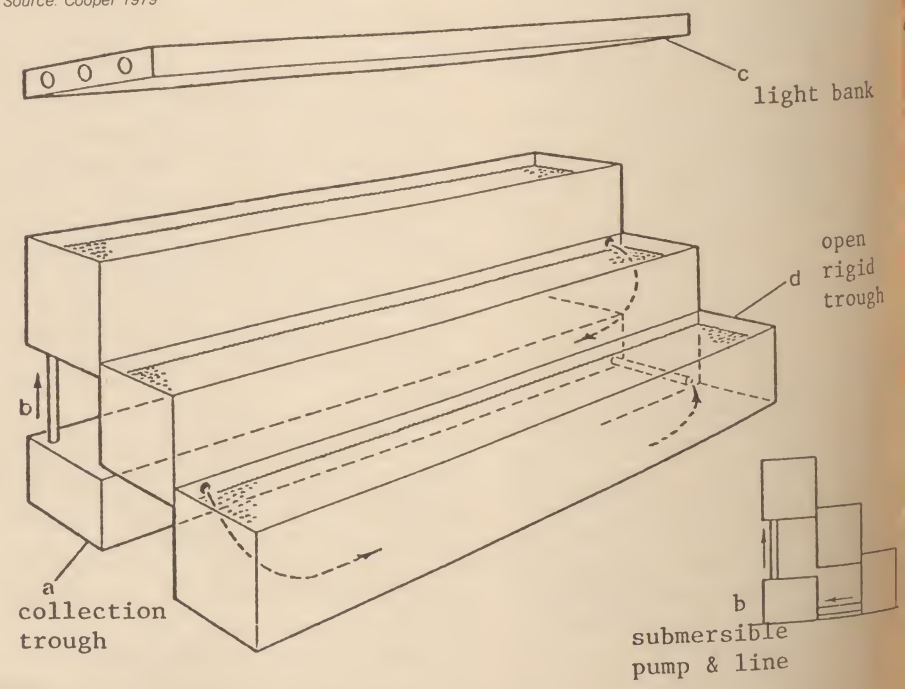


Figure 1. Aggregate hydroponic system (Cooper, 1979).

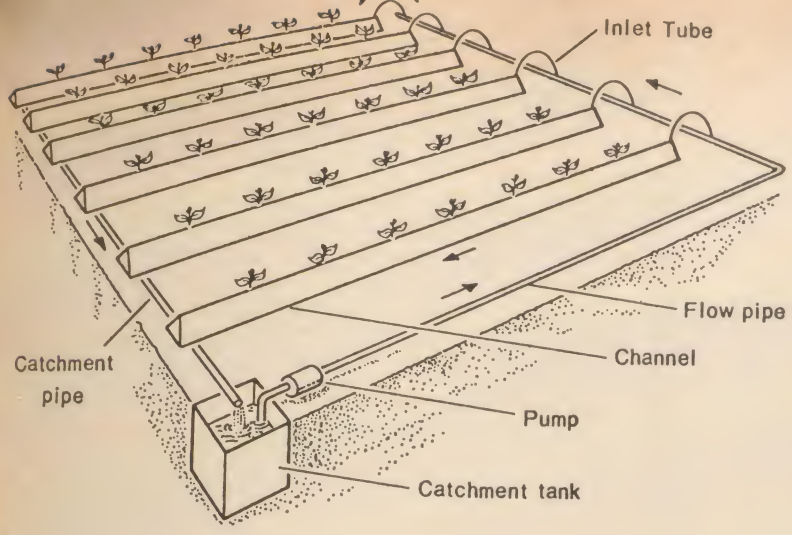


Figure 2. Nutrient film system (Windsor *et al.*, 1979).

Finally, hydroponics growing is a technique that allows the grower to feed his plants accurately. It is not a panacea; yields will not improve immeasurably, and reports to that effect usually reflect a faster turnaround time for the unit rather than higher yields per plan. Hydroponics does not replace good management practices and, consequently, will not make a poor grower good — but can make a good grower better.

References

Bentley, M.1973. Hydroponics Plus. O'Connor Printers, Sioux Falls, South Dakota.

Bible, B. 1976. Hydroponics, Soilless Culture of Plants. Dept. of Horticulture, Macdonald College.

*Cooper, A. 1979. The ABC of NFT. Grower Books, London.

*Douglas, J.S. 1976. Advanced guide to hydroponics (soilless cultivation). Pelham Books Pub., London, England.

Lemm, J. 1977. Home Hydroponics — and how to do it! Crown Publishers, New York, N.Y.

Maas, E.F., and R.M. Adamson. 1980. Agriculture Canada Publication 1460.

Ministry of Agriculture and Food of Ontario. Hydroponics, Factsheet 200/24.

————. Nutrient solutions for Hydroponics, Factsheet 200/532.

————. The 1981-82 Greenhouse vegetable production recommendations. Publication #365.

*Winsor, G.W., R.G. Herd, and D. Price. 1979. Nutrient Film Technique. Grower'sBulletin #5, Glasshouse Research Institute, Littlehampton, West Sussex, England.

*Available from Grower Books, 49 Doughty St., London, England WC1.

WINTER INJURY TO APPLE TREES

by Professor D.J.I. Buszard
Department of Plant Science

For Quebec's apple producers last winter was the worst for a very long time. Many trees died or were so severely damaged as to be no longer commercially useful. Some others, apparently undamaged, produced almost no fruits because of late frost damage to the flowers. These injuries were the result not solely of the severe winter but also of a series of events which started last spring.

In the spring of 1980 it was apparent that many trees were carrying a lot of flowers. Fine weather during the blossom period led to a very high level of bee activity, pollination was good, and many fruits were set. As these fruits developed, they first used stored reserves and later carbohydrates produced by photosynthesis of the leaves. Towards the end of the summer drought conditions were experienced in many areas, and trees carrying a heavy crop were under stress, unable to produce sufficient carbohydrates or to absorb sufficient minerals to satisfy the demands of developing fruits and new shoots. By the end of the season, these effects could be seen in the small fruit size attained on trees which had not been thinned. Normally the tree produces sufficient carbohydrates to swell the fruits and later to accumulate reserves in the wood for the winter; in 1980 this did not happen.

Apple trees become dormant in the autumn; the external symptom of this is leaf fall while internally many physiological changes are occurring to enable the tree to withstand low temperatures. This process, called acclimation, is a gradual one beginning with the accumulation of carbohydrates by photosynthesis, particularly after the fruits have been harvested. Later, before they fall, the leaf contents are re-absorbed by the tree to augment the mineral reserves. After leaf fall the living cells of the tree are rich in soluble carbohydrates and minerals, mainly in the form of amino acids and phospholipids. By physical and physiological means these compounds enable the cells to resist freezing. Frost injury occurs when ice crystals form inside living cells, rupturing membranes and organelles.

On September 29, 1980, a severe night frost was experienced in many parts of southern Quebec, and the leaves of apple trees were killed and abscised before the contents had been re-absorbed. Once the trees lost their leaves there was no possibility of further carbohydrate or mineral accumulation. In normal growing seasons, even if the reserves have been depleted by bearing a heavy crop, after the fruit has been harvested further photosynthesis makes up the losses and enables the tree to become winter hardy.

Acclimation, the process of becoming winter hardy, might simply be considered analogous to adding as much salt and sugar as possible to a glass of water to depress the freezing point. However, within the plant more complex changes take place including dehydration and the formation of complex organic molecules holding water in such a conformation that it cannot crystallize at low temperatures. These complex changes take place gradually as a result of prolonged low temperatures, and once they have occurred the tree can withstand temperatures as low as −40°C. It is likely that in 1980 fluctuating temperatures from September to Christmas and the weakened state of the trees (as a result of the heavy crop, drought, and premature leaf fall) led to incomplete acclimation, so that the trees were not able to withstand the extreme cold from December 25, 1980, to the end of January 1981. Normally snow cover provides insulation for the sensitive roots and lower trunk; in 1980-81 there was little or no snow and the surface roots were esposed to extreme cold.

Once apple trees have become dormant they require a period of chilling before growth may recommence. This period varies between 800 and 1,700 hours, depending on the cultivar. Once this period is completed the tree will start to grow as soon as the temperature goes above about 6°C. In February 1981 the temperature was well above freezing for several days, and many shrubs and trees started to grow and bud out.

Once growth has commenced cold hardiness is gradually lost, and the tree is unable to withstand further cold. In March and April 1981 the weather returned to "normal" and the trees were subjected to temperatures well below freezing; some which had broken dormancy were unable to withstand these and further damage occurred.

Commercial apple trees are always made up of two parts, the scion variety (e.g., McIntosh) grafted on to a rootstock. This complicates the phenomena of acclimation and winter injury because different responses may be expected from the two parts, and they may interact and effect one another. Apple

Above: Blackheart showing after a McIntosh tree on seedling rootstock has been cut down.
Below: Severe sunscald (southwest injury) on the trunk of a young Spartan apple tree.

varieties have been selected for their fruit quality and yield and, unfortunately, cold hardiness has not necessarily been selected. Rootstocks, on the other hand, have been selected for size control and winter hardiness, and hardy stocks are available. However, a rootstock which is very hardy in Sweden (where they have continuous low temperatures during the winter) may not be at all suited for eastern Canada where fluctuating temperatures are normally experienced. One of the once widely planted rootstocks *Malus robusta* 5 in particular was severely damaged last winter because it has a very short cold requirement. It began growing very quickly as soon as the temperature rose above freezing and was unable to withstand the low temperatures in March and April. Other rootstocks selected for size control, such as the Malling series, were bred in England and not originally chosen with winter hardiness in mind; so their performance is variable — M7, M26 and M9 seem hardy while MM106 is less so. Many of the old trees in Quebec are on seedling rootstocks which are genetically variable and show differing levels of winter hardiness. Ideally, a rootstock for Quebec should have a very long dormancy period, commencing early in the autumn and remaining dormant through the fluctuating temperatures experienced in the early spring months.

Winter injury symptoms

Winter injury may take varying forms, depending on the time of injury and the part of the tree affected. Broadly the tree can be divided into bark, wood, and buds,

as these show different levels of hardiness.

Bark injury occurs most frequently on the southwest side of the trunk and major branches, at the base of the trunk, and in narrow branch crotches.

Sunscald (southwest injury) occurs most commonly in orchards on southerly slopes and is the result of fluctuating temperatures caused by the bark on the southwest side absorbing radiant energy on bright sunny winter days, then suddenly refreezing at night. The bark dies and during the next season will peel back, exposing the cambium which will die. This type of injury is also seen on the remaining upper branches of old trees which have been heavily pruned to reduce their height.

A less serious form of bark injury is vertical splitting; this occurs in very low temperatures as a result of physical stresses within the tree. In severe cases the wood beneath the bark may also crack. In the spring small cracks callus over and heal; larger cracks may dry open and allow the entry of disease-causing organisms.

Perhaps the most devastating bark injury is that which occurs on the lower trunk and roots. The parts of the tree closest to the soil surface are the last to become winter hardy and, if frost penetrates the soil deeply, the upper root zone and lower trunk may be killed. This type of injury is especially prevalent in seasons when intense cold is experienced and there is little or no snow cover. The following spring affected trees begin to grow normally, using stored reserves, but later on when the tree is in full leaf the damaged root system is unable to support it and the tree dies. This sort of injury occurred extensively last winter.

Wood injury also occurred widely last winter as tip die-back. The tips of one-year wood ceased growth too late last season and were unable to become hardy. The damage showed in the spring when the shoot tips shrivelled and failed to leaf out.

Another type of wood injury is Blackheart, a condition in which the internal part of the trunk freezes, while the cambium, phloem, and bark are unaffected. The central area becomes black over a period of several years, and disease organisms may enter, weaken, and finally kill the tree.

Injury to leaf and flower buds may occur at low temperatures in late winter and spring. Flower buds become increasingly sensitive to cold as they develop, and by the time the flowers open they may be damaged by temperatures just below freezing. Frosts in April and May 1981 damaged the developing female parts of the flowers (which give rise to the fruit) leading to female sterility. These flowers opened normally, but could be distinguished from viable flowers by the browned ovaries and ovules.

Avoiding winter injury

How may the dangers of winter injury, in its various forms, be minimized? It is unlikely that winters as severe as that experienced in 1980-81 will occur frequently, but when they do they will seriously damage orchards. There are some steps we can take to minimize the risks in our new planting.

Cold tolerant cultivars and rootstocks are available. The Quebec Reorientation de l'Industrie Pomicole Program recommends the dwarfing rootstocks, Ottawa 3, M9, and M26; these are all hardy. The cultivars recommended: Cortland, Empire, Jersey Mac, and Spartan are moderately hardy, but all suffered some damage last winter. McIntosh seems to be quite hardly, but other old cultivars like Delicious, Russet, and Hume were severely damaged last winter. Early ripening cultivars are preferable as they allow the tree a longer time in late summer to accumulate carbohydrates.

The situation of the orchard is also very important, good air and water drainage are prerequisites, and windbreaks should be planted to reduce wind chill problems and increase snow retention. Poor drainage leads to suboptimal root growth, which predisposes trees to winter injury.

Orchard management practices may also influence the susceptibility of trees to winter injury and by improving them we may reduce losses in severe winters.

Any factor which causes stress in the tree during the summer reduces the accumulation of carbohydrates. Disease or insect problems which reduce leaf efficiency, too heavy crop load, drought, mineral deficiencies — any of these reduce the tree's ability to acclimate. The problem may be exacerbated by the habit of some growers of not harvesting fruit from the trees in seasons when yield is heavy and there is an over-supply at the market, thus preventing the tree from accumulating carbohydrates after the fruit has been removed. In heavy crop years it is really vital to harvest as early as possible to allow the trees to recover and prepare for the winter.

Dormant-season pruning should be delayed until as late as possible in the winter to allow the tree to become completely dormant, and it should not be done during periods of intense cold.

It is important that the tree stops growing early enough to become hardy by the time very low temperatures are experienced. This is a varietal characteristic but may be influenced by management, particularly the fertilizer regime. Extra nitrogen applied too late in the season will lead to extended growth; nitrogen should be applied in early spring, when it will benefit flower development and fruit set.

The problem of sunscald may be reduced significantly by painting the trunks and susceptible scaffold branches with white latex paint. This will reflect much of the incident radiation and prevent the trunk from thawing so quickly in direct sunlight. This treatment may also be made effective against rodents, by mixing one pound Thiram and two quarts of water with one gallon of the paint.

In modern intensive orchards a soil management system of herbicide strips under the trees and permanent grass alleyways is commonly employed and may be used to help slow down growth in the autumn. By ceasing irrigation (if used) and allowing the grass to grow longer, after

(Continued on page 16)

FLUID DRILLING

by Professor K.A. Stewart
Department of Plant Science

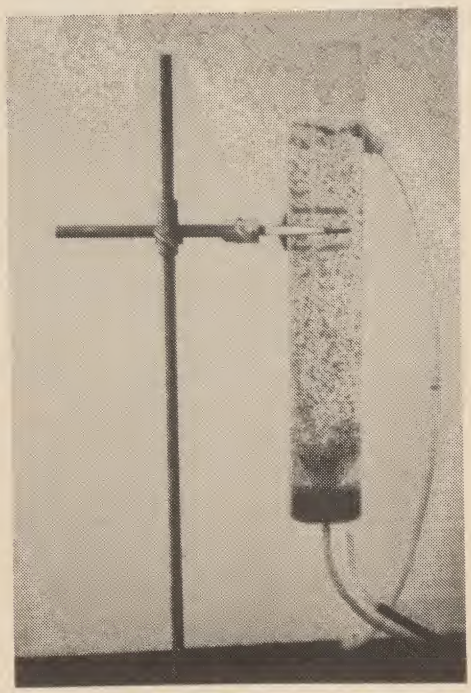
The term fluid drilling is used to describe a method of sowing pre-germinated seeds suspended in a protective gel. The technique was first developed by Elliott (1967) in an attempt to re-establish pasture land that had been killed by herbicide application. Results from this experiment indicated that fluid drilled material produced a more uniform crop stand. After his initial experimentation, work was carried on at the National Vegetable Research Station in England on a range of vegetable crops.

The fluid drilling system consists of three major operations (a) seed preparation, (b) gel preparation, and (c) the drilling of the germinated seeds (Gray, 1981).

A. Seed Germination

For experimental work, seeds are germinated in aerated water held in plastic columns (Photo 1). Aeration is necessary in order to prevent the occurrence of anaerobic respiration. The temperature of the water is maintained between 18°C and 25°C in order to provide optimal conditions for germination (Gray, 1981). The column is provided with both an intake and overflow tube to allow the continual introduction of fresh water into the system in order to leach germination inhibitors present on the seed coat. The seeds remain in the water until a radical length of 2 mm has been attained.

On a commercial scale seeds are germinated to the 2 mm radical stage in either a sand bed or in a mesh bag where the seeds undergo a repeated wetting and drying sequence. After the seeds have germinated, it is necessary to separate viable from non-viable seeds. This has been attempted through the use of differential resistance of germinated and non-germinated seeds to passage through water (Currah, 1977), and sucrose density techniques (Taylor *et al.*, 1978). The efficiency of both these methods depends on the proportion of germinated material in the sample. High proportion leads to good separation and, conversely, poor germination results in a more complicated separation procedure with greatly increased wastage. Accordingly, producers consistently oversow with a mixture of the two seed types. Normally, seed is sown immediately after germination has been observed. However, a suitable method of storing seed must be found in case environmental conditions make immediate sowing impracticable. The method must involve as little manipulation as possible due to the fragile condition of the radicals. Seeds can be held in cooled aerated water (Salter, 1978) or on mesh trays in a humidified refrigerator (Lindsay *et al,* 1974).



In experimental work seeds are germinated in aerated water held in plastic columns.

B. Gel Preparation

Several materials are available to prepare the gel. Of these only Laponite (a synthetic clay) has given consistently higher and earlier emergence under a range of conditions (Gray, 1981).

Attempts have been made (with limited success) to introduce hormones, fertilizers, and fungicides into the gel in order to provide an optimal micro-environment for seedling growth (Gray and Bryan, 1978; Hardaker and Hardwick, 1978; Entwistle, 1979).

C. Seed Drilling

Machinery has been developed to accommodate fluid drilling and ranges from a simple manual device (Figure 1) to a fully mechanized four-row seeder (Figure 2). Prior to sowing, the land must be prepared and a fine tilth established. Then a furrow is opened into which the seed gel mixture is laid. The gel must be covered either with soil or an anticrustant (vermiculite) and then rolled in to establish the optimal soil environment. An adequate water supply is required to prevent solidification of the gel and consequent trapping of the seed in the mixture. This technique is suitable for evaluation in Quebec as reports have indicated that plants started using this method were earlier, had a more predictable field emergence (particularly under cool soil temperatures), and therefore, a more uniform stand with higher yields (Salter, 1978).

Once field emergence has been achieved then another problem arises. The environmental conditions under which seedlings emerge in Quebec in May and June can be extremely harsh. Consequently, it is necessary to combine fluid drilling with two other techniques in order to promote seedling establishment. The first technique is the application of plastic mulch which is applied immediately after the seed has been fluid drilled and slit where the seeds are expected to germinate (Photo 2). This mulching will protect the fluid drilled material by increasing the soil temperature and moisture-holding capacity and by reducing the amount of weed growth, thus lessening the competition for available nutrients and light. The mulch only influences the soil environment; therefore, mini tunnels or floating mulch must be used to control the aerial environment. In the

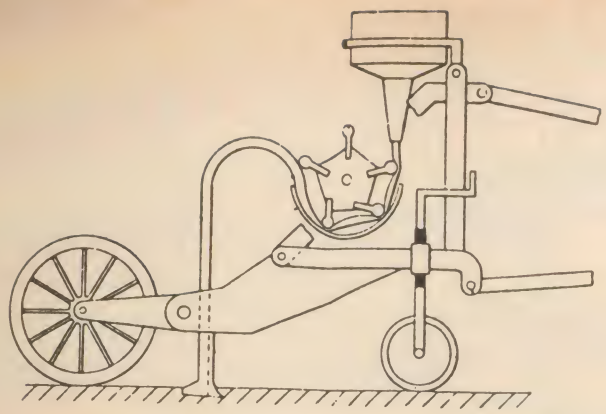


Figure 1. An early fluid drill from Elliott's patent.

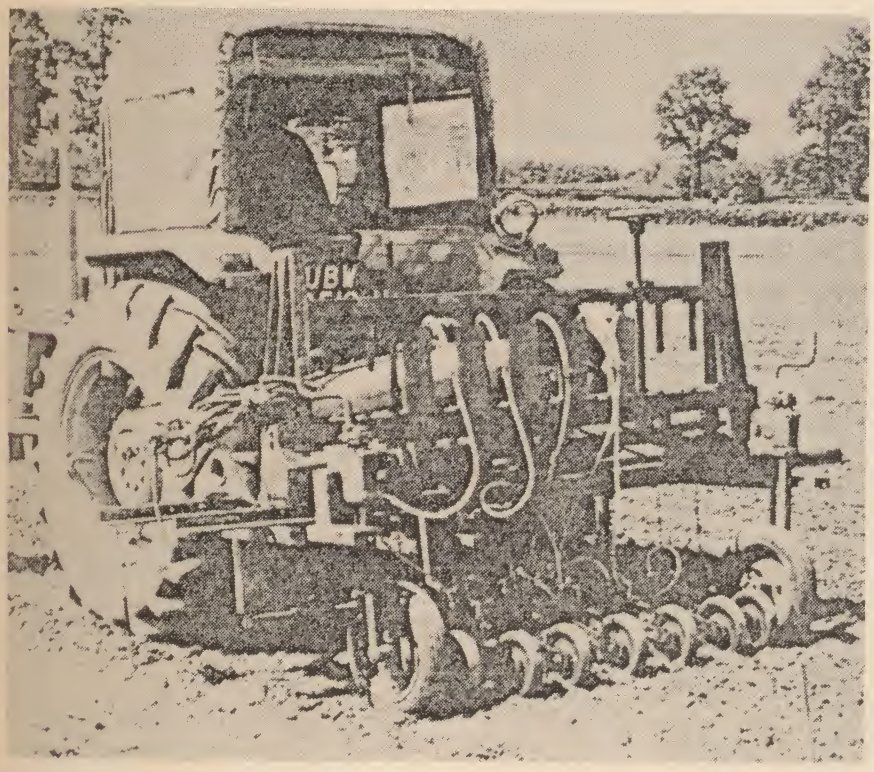
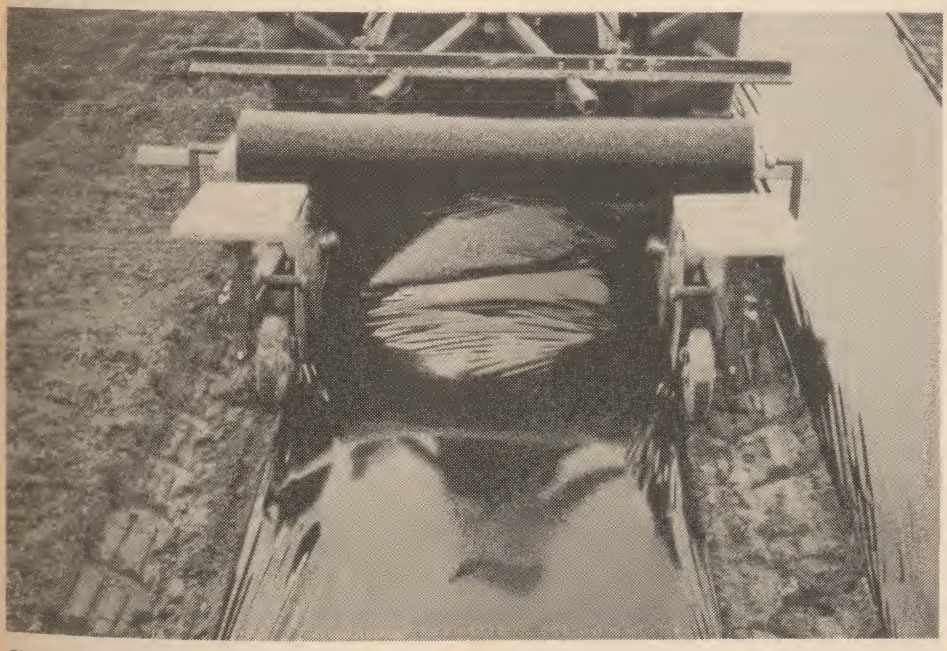


Figure 2. An experimental fluid drill based on the piston principle.



Plastic mutch is applied immediately after the seed has been fluid drilled and slit where the seeds are expected to germinate. This increases the soil temperature and moisture-holding capacity.

case of the former, plastic is stretched tight over a wooden or metal frame which is placed over the plants. One of the difficulties encountered with this system is watering. Unless a trickle irrigation system is installed underneath the tunnel, it becomes necessary to remove and replace the cover for each irrigation period. A floating mulch consisting of transparent perforated plastic is applied using a normal mulch layer which cuts the soil on either side, buries the plastic, and lays the plastic taut in the longitudinal direction. The floating mulch lies close to the ground until the plants have emerged and then is lifted away from the soil surface. As the plants grow, the slits are forced open with the result that the mulch tends to float above the crop canopy. Both tunnels and floating mulch are left on the crop for a period of five to six weeks, depending on weather conditions and crop growth.

These techniques are currently under investigation in the Department of Plant Science in an attempt to further improve seedling growing conditions.

References

Currah, I.E. 1977. Hydraulic fractionation of seeds. Rpt. Natl. Veg. Res. Sta., Wellesbourne, 1976. p. 67.

Elliott, J.G. 1967. The sowing of seeds in aqueous fluid. Second Annu. Rpt. Weed Research Organisation. Begbroke Hill, Oxford. p. 31-32.

Entwistle, A.R. 1979. Fluid drilled salad onions. Rpt. Natl. Veg. Res. Sta., Wellesbourne, 1978. p. 72-73.

Gray, D. 1981. Fluid drilling of vegetable seeds. Horticultural Reviews. Vol. 3. p. 1-28.

Gray, D. and H.H. Bryan. 1978. Establishment of crops by fluid drilling. Incorporation of growth-promoting substances into the gel carrier. Rpt. Natl. Veg. Res. Sta., Wellesbourne, 1977. p. 66.

Gray, D., J.R.A. Steckel, and J.A. Ward. 1980. A comparison of methods of growing tomato transplants. Scientia Hort. 12, 125-133.

Hardaker, J.M., and R.C. Hardwick. 1978. A note on Rhizobium inoculation of beams *Phasealus vulgaris* using the fluid drilling technique. Expt. Agr. 14: 17-21.

Lindsay, R.T., M.A. Neale, and H.J.M. Messer. 1974. The performance of an ice-bank cooling system for use in vegetable storage. Acta Hort. 38: 421-442.

Salter, P.J. 1978a. Techniques and prospects for "fluid drilling" of vegetable crops. Acta Hort. 72:101-108.

Taylor, A.G., J.E. Motes, and H.C. Price. 1978. Separating germinated from ungerminated seed by specific gravity. HortScience 13:481-482.

The Family Farm

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INCOME STABILIZATION INSURANCE NOW COVERS LAMB PRODUCERS

The Quebec Minister of Agriculture, Fisheries, and Food, Mr. Jean Garon, announced recently the adoption by the Council of Ministers of a new income stabilization insurance plan which has been designed for Quebec's lamb producers.

It is the nineth income stabilization insurance system to be adopted by the Quebec government, which places us among the best protected agricultural regions in this domain, both for the number of productions covered and for the level of guaranteed income.

Indeed, lamb has become the eighteenth insured production in Quebec. Certain plans, such as those for cereals and beef cattle, cover many different crops and many different types of production. In addition, contrary to the income stabilization policy of the federal government, the Quebec system guarantees to the producers not a price but an income based on the cost of production and a salary corresponding to a high percentage of the average salary of a specialized worker.

Developing Production

Lamb production is currently in full expansion in Quebec. In fact, since 1977 there has been a total increase in the stock by 88 per cent, which represents an average yearly growth of 17.1 per cent. During a census carried out in January 1981, the Ministry of Agriculture, Fisheries, and Food counted 60,000 ewes spread among 700 producers, which gives the possibility of evaluating the total lamb production for 1981 at 67,800 head for a value of more than $4 million.

The development of lamb production has been supported by a program of investment assistance for the construction of modern buildings. During the 1980-81 year, 232 requests for grants were accepted for a total assistance of $1,118,600, while for the current year the corresponding figures are 267 requests for $1,927,450 in grants. Furthermore, the Ministry has given concrete assistance for the formation of purebred basic herds to improve the genetic quality of the ewes, an essential condition for the success of this production. Thus, a grant of $117,000 was given to the enterprise Les Bergeries de la Neigette of Trinité des Monts in Rimouski County to pay for the transportation costs of an 800-head flock coming from New Zealand.

Production is Covered from April 1, 1981

The plan recently announced will covered the losses encountered by the eligible producers for animals marketed since April 1, 1981.

Since the decision of the Council of Ministers was taken on October 20 and the new plan allows for a 90-day adhesion period from that date, interested producers have, therefore, until January 17, 1982, to insure their flock for the period from April 1, 1981 to March 31, 1982. Here are the principal regulations of this plan:

— Adhesion to this plan is on a voluntary basic but a producer must be insured for a minimum period of five years;
— To be eligible for the plan, the farm must have a flock of at least 50 ewes while the maximum number of animals which can be insured is 400 head for an individual enterprise and 800 head in the case of a farm operated by at least two recognized producers;
— The plan is open to the sheep producers who are fattening lambs for slaughter;
— The remuneration included in the cost of production has been established at 90 per cent of the average salary of a specialized worker.

THIRD SYMPOSIUM ON SHEEP PRODUCTION: "TOWARDS AN INTENSIFICATION OF PRODUCTION"

"It is a must to increase the profitability of our enterprises, to use modern tools of production, and to give much more attention to our products." These are the terms used by Mr. Wilfried Holtmann, President of the Animal Production Council of Quebec on November 5 during a symposium on sheep production.

Using the slogan "Towards the Intensification of Sheep Production," this meeting was held in the Quebec Congress Municipal Centre and had some 340 people in attendance. Sheep production has seen a renewal in popularity in many regions of Quebec during the last few years. The establishment of regional assistance programs for the development of sheep production has contributed to this.

This production, which is less demanding in investment and in labour, and is without quotas, attracts the attention of new producers.

Aware that it has to be started from scratch and that success depends on putting together all their experience, the producers will try to get on the Quebec market by insuring the regularity of production and a superior quality of their product.

Selling at the Right Time: A Primary Decision

Lyne Fournier, Agronome, in the Department of Production Economics of the Ministry of Agriculture, Fisheries, and Food, reminds us that the management of the enterprise is a priority. It is essential to know the cost of production if one wants to determine the best market in which to sell the product.

A few general principles must be retained. First, the Easter lamb market is a market of opportunity. The producer generally profits from a short period of very good prices. This season ended, there are as many advantages of selling the product on the heavy lamb market as long as one possesses the knowledge of the fluctuation of prices. As well, with the knowledge of the ratio of the cost of production, the producer is able to determine the best market each year.

Three Lambings in Two Years

For a producer who wants to do it, three lambings in two years are possible and feasible, according to Mr. Gervais Darisse, Agronome from the Ministry in Trois-Pistoles. One has to be prepared to devote additional work to it, to adequately control the surroundings, and to give great attention to the control and management of the flock which will be more complex because of the number of periods of lambing and breeding.

Artificial Insemination of Sheep in Quebec

Mr. Jacques Besançon, a Ph.D student in experimental medicine in the endocrinology and metabolism laboratory of CHUL, explained the advantages of insemination, the current state of research, and the prospectus for the future.

Developed 10 years ago in France, this technique is used in all the countries of the world. Applied and successful in Quebec, the producer will be able to reach his objective, which is to increase the percentage of fertility, particularly in the spring and to profit from the use of synchronization of the estrus technique. However, the producer will have to have semen from tested rams which will be able to improve specific characteristics that he wants for profitability. Then, the establisment of one or more artificial insemination centres permitting the development of a sheep genetic program becomes a necessity.

Financing and Investment Needs

In his talk, Mr. Jean-Marc Lacasse, Agronome in the Department of Research and Planning, O.C.A.Q., presented the characteristics of the main credit programs offered by the public and private sectors and the financing activities in sheep production. Public agricultural financing organizations supported in 1980-81 36 producers for an estimated capacity of 8,000 ewes. The needs in investments for the farms which were financed are $585 per ewe. The animals represent 32 per cent of the assets after the execution of the projects.

Two criteria of credit accessibility which are used by the lenders should be kept in mind. They are the physical guarantee and the reinbursement capability.

Silage and Sheep Production

Much less tolerant than cattle to a poor quality silage and more susceptible to infections, sheep require first-quality silage. One must ensure nutritive equilibrium at all levels: protein, energy, vitamins, etc. Mr. Laval Tremblay, Agronome from the Ministry in Buckingham, indicated that sheep producers can derive profit from silage but that it requires a greater attention. The producer must have each of the feeds that compose the sheeps' rations analyzed. He must establish feeding programs keeping in mind the period in which the animal is.

Not only will the lamb have a well developed rumen, but it must also have the physical capacity to ingest high moisture feed.

POULTRY PRODUCTION IN QUEBEC: SITUATION AND DEVELOPMENT

The poultry industry is the third most important agricultural sector in Quebec, immediately after dairy production and swine production. In addition to being one of the best developed industries from one end to the other of the agro-food chain, it amounts to 13 per cent of the agricultural cash income.

The technological and genetic improvements, as well as disease control have made it such that produc-

ing is no more a problem. During the 1960-70 decade, there was an unlimited expansion in the production of poultry meat, with the results that are known: surplus of producducers and enterprises. It was, therefore, essential to establish the mechanisms of supply control. The establishment of marketing boards in the different poultry sectors has permitted the planning of volumes of production and marketing, the management of surpluses and the fixing and uniformization of prices to the producers.

On the other hand, there are many points which are still undecided: an adjustment is a must with regard to the prices paid to egg producers in relation to costs, as well as a better distribution of the national quota and more adequate planning between reproduction and commercial production.

Chickens

Chickens represent 80 per cent of poultry production in Quebec. Since 1973, in spite of the decrease in the number of producers of chickens for meat, the total production in Quebec has increased, as well as the average size of the enterprises.

The popularity of chicken places Quebec in the lead over other provinces in capturing 33 per cent of the Canadian market. But, since 1975, Quebec feels a slight decrease to the benefit of Ontario.

From 1970 to 1979, chicken consumption went from 19 kilos to 21.2 kilos per capita. From now until 1990, an annual anticipated increase is set at 1.1 per cent to reach a consumption of 22 kilos per capita at the end of the current decade.

Depending on the opening of new markets, the rate of utilization of production capacities, currently at 66 per cent, will increase to 85 per cent in 1990. In order to accomplish this, it is necessary first of all to favour a greater increase in consumption as well as to take back the Quebec market, which is currently in the hands of the Americans, and to develop export markets.

Turkeys

Turkey production has shown an interesting increase from the beginning of 1970 and constitutes a well-structured production. The establishment of a marketing board and the creation of a Canadian marketing board has contributed to the stability of the turkey market, which represents currently 15 per cent of poultry production in Quebec.

The creation of turkey strains developed and improved in Quebec has favoured the penetration of the Quebec market since 1978. We find them on 50 per cent of the producers' farms.

Since Canadian production is under quota, the development of this sector is based on the increase in consumption per capita. The degree of self-sufficiently could go from 88.8 per cent where it was in 1979 to 96.6 per cent in 1990.

Eggs

The annual consumption of eggs, after having reached a floor of 15.4 dozen per person in 1978, has started a slight increase. The promotion efforts, the purpose of which is the rehabilitation of the egg in nutrition, allows a forecast of an annual increase of 1.5 per cent in Quebec production until 1990. Consumption will be maintained then at about 16.5 dozen per capita. Self-sufficiently would increase slightly, going from 65.9 per cent in 1979 to 69.4 per cent in 1990.

The Future

The evolution of poultry production in Quebec is intimately tied with the future of the Canadian marketing boards which manage production. The future of egg producers depends on solutions which will be brought about to the system of price fixing while making sure that the producers can be paid in relation to their cost of production. The management of production surpluses and the more equitable sharing of the Canadian market between the provinces will contribute to improve the situation for poultry producers.

(Continued from page 11)

The effect of a severe longitudinal bark crack, caused by severe cold. This crack never healed and the heart wood has rotted.

harvest, excess water and nitrogen are used up and tree growth slowed down.

Generally a good site with adequate drainage and wind protection and the correct choice of rootstocks and cultivars suitable for Quebec will give the best chances of success. Any factors which contribute to stress or late growth make trees more susceptible to winter injury and the enterprise less likely to succeed. As with all orchard problems good management is the answer.

This Month with the QWI

Dear Fellow Institute Members:

Here we are at the festive season, and we in Canada have much to be thankful for. Love, families, friends, homes, food, and most important of all — freedom.

As the poet says: "Christmas is love." The real Christmas feeling, that warm friendly glow, comes from greeting the people, we're happy to know.

Let us at this special time of year remember that it is the little things in life that mean the most to us. Let us set aside our differences.

Once again it is my wish that each one of you will have a blessed, peaceful, and joyous Christmas and a happy and prosperous 1982.

Ina Kilgour
President,
Quebec Women's Institutes

Scholastic Awards Banquet

Once again it was my pleasure to attend the Scholastic Awards Banquet at the Macdonald Campus of McGill University.

A reception was held in the Centennial Centre lounge prior to the banquet, and the donors and the recipients had the privilege of meeting one another. The Banquet was held in the Centennial Centre ballroom with Professor R.S. Broughton as Chairman. Everyone was welcomed by Dean L.E. Lloyd. I had a most pleasant evening with the three recipients of the Quebec Women's Institutes Bursaries.

The Frederica Campbell MacFarlane Prize was awarded to Miss Josee Cardinal, of Nicolet, who is in her last year and is majoring in Dietetics. She has a cumulative grade point average of 3.29 out of a possible 4.00 and is hoping to get employment overseas as she would like to travel.

The Mrs. Alfred Watt Memorial Prize was awarded to Miss Claude Larouche of Dolbeau. She, too, is majoring in Dietetics. Miss Larouche was planning to attend a very interesting workshop on the interpretation of hospital laboratory results of medical tests in Quebec City. She has a cumulative grade point average of 3.21 out of a possible 4.00.

Then, I think that Mr. Jeffrey McVittie of North Hatley, who was the recipient of the Quebec Women's Institute Burary in the Diploma in Agriculture Program, was one of the most likeable and interesting young gentlemen that I have every met. Some years ago, the family farm was dispersed because of other commitments, but now Jeff is hoping to be able to buy a small beef farm or to be able to go into partnership. He wishes very much to farm and is eager to get started. He spent the summer working on a very large farm and enjoyed it very much.

I only wish that every one of you could have been present to spend the enjoyable evening that I had the pleasure of doing. The three young students were friendly and alert, and it is an evening that I will long remember.

Mrs. Ina Kilgour,
President,
Quebec Women's Institutes

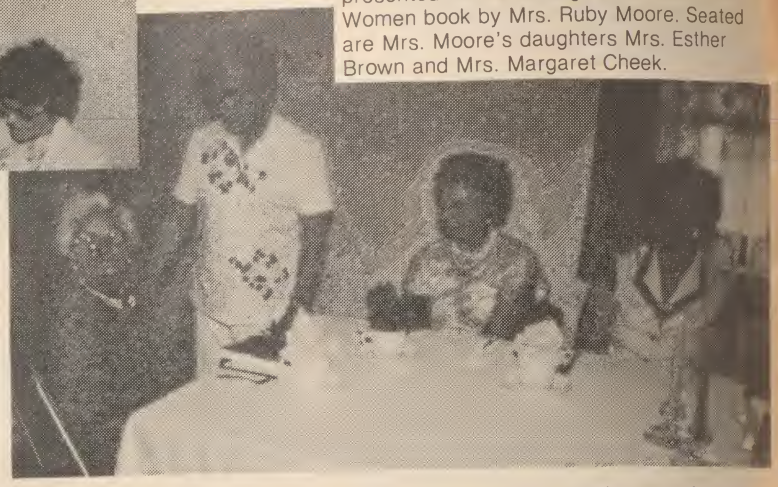
World Food Day

A special program to mark World Food Day was prepared by Mrs. R. Schimmelpfeng and Mrs. J. Robertson at the Hemmingford WI. October 16, 1981 was the 36th anniversary of the formation of the United Nations' Food and Agriculture Organization (FAO). The UN asked all member states to observe this day as World Food Day. It was hoped that programs would be carried out to make people more aware of food growing, distribution, and the problems entailed in many parts of the world.

FAO's hope was that hunger would be eliminated in the world, but in many parts of the developing countries people, mainly children, are dying from lack of food. The reasons for this are very complex, not the least being the difficulty of making sure that the ones in actual need are the ones receiving food aid.

Mrs. Robertson pointed out that our best way to help is through the Associated Country Women of the World organization. ACWW members in the developing countries assess their needs and present them to ACWW headquarters. Member groups in other parts of the world can then decide on the projects they can support. In Canada, the Women's Institutes work closely with the Canadian International Development Agency in Ottawa. Donations from the WI toward a project are matched (sometimes tripled) by CIDA, who supervise the project in the country requesting help so that the aid reaches those who need it.

Materials on what is being done to try to overcome this problem of hunger and samples of the types of food grown in the Third World were on display. Mrs. Schimmelpfeng and Mrs. Robertson had prepared samples of dishes from West and East Africa and Mexico, and members were able to taste them.



Left: the head table at Stanbridge East's 60th anniversary with President Mrs. Elizabeth Biggs addressing the gathering. Below: Mrs. Bernice Moore, a member for 60 years, being presented with a corsage and the Pioneer Women book by Mrs. Ruby Moore. Seated are Mrs. Moore's daughters Mrs. Esther Brown and Mrs. Margaret Cheek.

Dear Members,

The many pictures in the July/August issue of the Journal brought back happy memories of the days of last summer's Convention at Macdonald. The photographs of the lovely doll display, the County Presidents with their flags promoting ACWW, QWI President Ina Kilgour donating her Coins for Friendship, and the different ladies selling books, spoons, or handicrafts, thereby adding something special to the days and also helping defray expenses of the QWI. All these pictures give vivid evidence of a great society to which we all belong.

In the meantime, our daily life governs us, or hopefully we govern it, with all the energy and the good feelings that we brought home from the Convention. In this spirit I opened the many letters that I received with your reports, and I found suggestions, hints and some wisdom — mostly in the mottoes — which I can pass on to the members of all branches.

Dalesville-Louise WI met with seven members and three guests and their speaker, the secretary of the Rosemere Orange Children's Home. He informed the audience of the foundation and the purpose of these institutions and mentioned that since the start in 1950 seven of such homes for children and senior citizens are in operation across Canada. All nationalities are accepted and from all types, schools, and churches. Families are thereby held together. The homes are kept in operation mostly by donations and by the help of different groups.

Arundel realized some money from the sale of cold drinks at the Canada Day celebrations and made a donation to the committee of the Day to help defray expences. They held a very successful bazaar to which all branch members contributed and on a later date, at an evening program, the judging of baskets of garden produce took place. There were some attractive and imaginative entries — the prize being won by Phyllis Swail. After the judging, all entries were raffled off. At another meeting, attended by 16 members and 17 guests, the speaker was Bluebell Stewart Phillips, an authoress and poetess, well known in the community. She read some of her poetry and several short stories based on her own experiences. Before the audience had realized it, two hours had passed. The Home Economic convener report dealt with junk foods finding their way to the Northwest Territories. Because the native people do not know the nutritional value of these kind of foods, a colour coding system is now used, which helps them to determine what has food value and what does not. It was decided to make donations to defray some of the experiences in running the library, to help the "Forget-me-not"-Campaign for crippled children, and cheques were sent to both local guide and scout organizations.

Guest speaker of the **Lakefield** branch was the Quebec Director for CanSave, Mrs. Berget Dessaulles. She told the members how donations to community development programs give life to a wide variety of projects undertaken with dignity in self-help and based upon a sharing of ressources. They provide not hand-outs but constructive assistance at the grass roots level to enable a community to recognize its problems and work upon its own solutions through early child care, education, and community development. She also mentioned how much the help from the different Women's Institute branches was needed and appreciated.

Upper Lachute East End sent a cheque to the Christian Childrens' Fund for a little boy that this group is sponsoring. Their guest speaker was Mr. James Moram, the area chimney sweep. He gave an interesting talk on his equipment and technique of cleaning a chimney and told them how important it is to keep the chimney clean.

Grenville branch's roll call dealt with the idea "that certain TV programs would be better off the air". Ideas ranged from "Incredible Hulk" to many of the advertisements which are so exaggerated. Later, in their meeting the members discussed what they could do to try to prevent juveniles from being allowed in at restricted movies. Why cannot all WI members in Quebec get together on this? A candle-light dinner united the members at their October meeting. It was not by design but out of necessity — no hydro power. Speaker of the evening was Mr. Jim Hoquard who interested the ladies and their husbands in business matters about banking. Even the mayor of Grenville and one of his colleagues of the municipality were there. Motions were made to donate to the L.R.H.S. "Spectrum", the Argenteuil Historical Society, and to an Organ Fund, already started, to help a gifted disabled girl in this area to receive musical training.

Melbourne Ridge WI presented Life Memberships to, left to right, Myrtle Johnston, Mary Wood, Noreen Wilkins, and Shirley Nelson.

Mrs. D. Taber, a Life Member and 50-year member, presenting a Life Membership to her daughter, Mrs. Noreen Wilkins.

Melbourne Ridge members took a day off to tour a bakery and have lunch at the Brome Lake Inn.

A highlight of **Frontier's** program was a talk given at the August meeting by Miss Audrey Morrison, a special education teacher. Members learned that there are different kinds of handicaps and a handicapped person can best be described as one who cannot cope as well as the average person. A physical handicap often leads to an emotional barrier and some emotionally disturbed children's behaviour problems are the result of having to cope and prove themselves to those more fortunate. Handicapped persons often have great abilities, are courageous, and can be an example to others, as we learned of Terry Fox. Miss Morrison advised getting to know a handicapped person and to remember that some of his or her behaviour may stem from the fact that he or she is scared when faced with some new situations. The monthly roll call: "What have I done for a senior citizen during the past month?" brought to light a variety of kindnesses that members were doing for others. Booklets entitled, "More Fun and Flavour with Spices" were distributed to members. More than recipes were found in the attractive publication; for instance, a history and explanation of spices, herbs, and seeds; a storage hint and suggestions on how to use spices for more flavour in our cooking. At an education meeting, members learned much as Mr. Masel Wilson showed slides of trees, birds, and flowers in both Florida and Canada, and at the next meeting Hazel Swail reported of experiences she had had on her visit to some European countries and on a tour of Russia in 1975. Hazel had learned of many of the restrictions in Russia that we hear about — passports were taken from the bus group each night at the hotel and were given back each morning on the bus; shopping was a frustrating experience; the drinking water was not good; churches were closed or near empty, and women do much of the pick and shovel work.

President Amy Mason welcomed members to the September meeting of the **Brownsburg** WI and thanked all who had helped with the successful Food Booth at Lachute Fair and also the display guards. The Publicity Convener read a warning from the director of the International Peace Research Institute, based in Stockholm, that a nuclear world war is becoming likely as the level of arms spending increases. In July, this group entertained the Dalesville-Louisa branch at the summer residence of a member in Dalesville. On this occasion a gift was presented to a newly married member, Mrs. G. Morrin, and prizes were given out to five members for their winning displays at the Lachute Fair. "Ways to save energy" was the roll call at the October meeting. The Agriculture Convener reported that Brownsburg W.I. offered prizes to the 4H club for the best Junior Calf and the best Intermediate Calf in both Holstein and Ayrshire classes. Mrs. Jocelyn Chevrier, the speaker at the meeting, spoke about the purpose of CAPAR, a training centre for the handicapped where they are helped become more self sufficient and, hopefully, to enter the "regular" market and integrate into regular society. They are divided evenly — 50 per cent women, 50 per cent men.

Pioneers W.I. called on Mr. George Donaldson, who spoke about and demonstrated "Scrimshaw". It is a primitive art form, begun by whalers as a pastime. They used a sharpened nail or a sailmaker's needle to make pictures on the teeth of sperm whales. Fine examples of this work are in museums and boutiques. This art has been revived, but the supply of whales' teeth — pure ivory — is increasingly hard to obtain. Bone, antlers, and plastic can be used. Mr. Donaldson uses whale teeth which he sands and polishes to a high gloss, then, using a stylus, skillfully etches a design on the surface. India ink is used to bring out the design. Then he uses various techniques of cross hatching and shading. It is here that the skill of the artist becomes apparent.

Marcil had a very young guest at the meeting, Tammy Sweetman, a Grade I student at Hopetown Elementary School. She presented Mrs. Edith Watt with three souvenir albums. These were prepared by each of the three classes who enjoyed a tour of Watt Farms, and depicted each child's impressions of the farm. The sum of $85 was spent on school prizes and trophies and a Charter Member, Mrs. Leila E. Walker, was presented with a gift of luggage prior to her departure to Edmonton, Alberta. The members rented a booth at the Agriculture Fair and held a very successful sale of home cooking and handicrafts. The Convener of Health and Welfare, Anne Nadeau, warned against the use of sun tan lotion and presented an article on migraine headaches. Ten members attended the Semi-Annual County Convention held in Matapedia. The Convener of Education, Hilda Prince, spoke on the drastic changes in Protestant School Boards and the possible elimination of Anglophone School Boards. Marjorie Sullivan spoke of the Literary Group and outlined their plans for showing films, etc.

Port Daniel members sent $25 and two ditty bags to Canadian Save the Children Fund.

Restigouche's roll call was a Bring and Buy Sale. They distributed literature on the metric system, purchased flowers for the urns at the local cemetery, and were the recipients of a beautiful quilt top.

Matapedia entertained at the Semi-Annual Convention. A new member, Mrs. Margaret Ann St. Onge, made and donated an afghan. All members are selling tickets on it and the drawing will be in December. A Mystery Parcel donated by Faye MacNaughton was won by Ida Allard.

South Bolton held a Rummage and Bake Sale with fair results. This money paid for the curtains that put the finishing touch on their W.I. Hall. Motto of the month was: "A budget is a family's attempt to live below its earnings."

Sutton held an agriculture meeting and Mrs. Monique Paquette, Horticulturist and owner of greenhouses, gave an informative talk on house plants, annual and perennial flowers, cutting and pruning small trees, how to condition the soil for gardening by fertilizing, and how to care for vegetables.

Austin's Citizenship Convener read an article on Prince Charles's wedding and also gave a history of St. Paul's Cathedral. The ladies entertained the members from **Brompton Road WI** by taking them on a tour of the St. Benoit du Lac Monastery. To continue their outing they went to Knowlton's Historical Museum.

Howick ladies had as a contest 12 musical selections on piano and members guessed fruits, grains, animals named in the words of the songs. Another contest question was to guess the number of kernels in an ear of corn.

Franklin Centre held a cookie contest and the money from a white elephant sale was given to the Coins for Friendship. Leaves of 20 different familiar trees were shown and it was not easy to name these trees. The members made — because they live in an apple-growing county — 80 apple pies at the Apple Festival and sold them in an hour.

Huntington branch had as guest speaker the local fire fighter Mr. Roy Younie. He spoke of the 10-minute period in which a person has to save himself. He mentioned never to fail to call the fire department first if there is any suggestion of a fire or even the fear of fire; he explained, furthermore, that the new materials used today in drapes, curtains, rugs, furniture, or pillow covers are highly inflammable, or if they do not burn in a flame, they develop toxic fumes. A person should crawl with the face along the floor for the safest air to breathe. There should be a sign at the door to aid firemen to know where children sleep or where elderly or handicapped persons live. The October meeting was devoted to the handicapped and the guest speaker was Miss Helen O'Connor, herself a handicapped person. She spoke for DEFI Huntingdon Challenge, a group which was formed in December 1980 for the handicapped and disabled. She spoke of what this group has accomplished so far, and of some of the things they hope to do. This sparked ideas for ramps for churches, public buildings, post offices, sidewalks, etc.

Hemmingford ladies had a quiz on blood pressure, true or false. They had a list to show ways to recycle and re-use plastic and glass bottles, newspapers, etc. Storing water or juice, making a funnel from a bottle top, splitting a plastic container for two planters for seedlings. They also had a Salvation Army Pick Up and gave money to the local school for book prizes. The highest academic achievement trophy — a shield — was donated to the top student. Money was given to help set up a "Workathon", a work shop in nearby Lacolle for local handicapped persons.

East Angus motto was: "The life of men seems to consist of leaving the country in order to earn enough in the city to recover their health in the country!" How true this is; many of us had this experience. The sum of $25 was given for a talent fund.

Brookbury held a writing contest in their local school with first and second prizes. They made a donation to the public speaking group and the Student Loan Fund and also bought spoons and glasses for the school cafeteria.

East Clifton's guest speaker, Mr. Martin van Lierop of Macdonald College, showed slides of Sri Lanka. He gave details of the country as to religions and products.

Sawyerville's ladies were very active. They prepared parcels for "Save the Children", assisted at a dinner in the school cafeteria, and gave another chicken pie dinner at the Senior Citizens Home. They invited the other five branches of their county to attend a tea with a food sale of home baking and novelties.

The **Gaspe County Women's Institute Fair** was held in Murdochville on September 12, 1981, with seven of the eight branches participating. The trophies for this event were won as follows: The "County Trophy" by **Wakeham;** the Clark Trophy" by **Wakeham;** the "Branch Effort Trophy" by **Douglastown;** the "Literature Trophy" by Mrs. Evelyn Davis, **Gaspe;** the "Cooking Trophy" by Mrs. Evelyn Davis, **Gaspe;** the "Vegetable Trophy" by Mrs. Eileen Capute, **Wakeham;** the "Flower Trophy" by Mrs. Eileen Capute, **Wakeham;** the "Handicraft Trophy" by Mrs. Stella Miller, **York;** the "Trophy for the most First Prizes" was won by: Mrs. Anne Hickey, **Murdochville** and Mrs. Bessie Patterson, **York;** the "Trophy for the most Entries" was won by: Mrs. Eva Patterson, **Wakeham** and Mrs. Stella Miller, **York;** and the "Trophy for Proficiency" by Mrs. Stella Miller, **York.**

Aylmer voted to give a donation to the Canadian Legion, and they will serve tea and cookies at the Ottawa Winter Fair. President Hilda Graham held a "Grocery list" contest, won by Mrs. E. Lusk. The Roll Call at their October meeting asked "Name a good deed you have done recently". The list of the handicraft competition for the coming year was discussed.

(News from the remaining Counties next Month.)

Ruth von Brentani
QWI Publicity Convener